

## APPENDIX G.1: TRANSPORTATION ACCIDENT INFORMATION AND DATA ANALYSIS

*“Every year, more than 40,000 Americans die and several hundred thousand are injured in transportation-related incidents, mainly from motor vehicle accidents. A small number of these fatalities and injuries result from the unintentional release of hazardous materials during the transport. For example, during each of the past 15 years, approximately 10 people died as a result of fires that occurred in gasoline-truck accidents, with truck drivers accounting for approximately 7 of the 10 deaths...For most hazardous materials...estimating the fatality and injury risks associated with their transportation is more difficult. Approximately 100,000 shipments of chlorine occur each year...since 1985, only one fatality and a handful of injuries have occurred as a result of accidents involving the transportation of chlorine in the United States.” (Brown et al. 2000)*

These comments from a National Transportation Risk Assessment study are indicative of the problem of trying to develop probabilities for risk associated with accidents that have a low frequency of occurrence. Their study (Brown et al. 2000) did not deal with infectious substances because their focus was on what constitutes at least 90 percent of the transportation risk from toxic-by-inhalation (TIH) materials and that did not include infectious substances.

Infectious substances (etiological agents) in transit are covered under the U.S. DOT regulations (49 CFR 171, 172, 173, and 178) for the safe transportation of hazardous materials. Regulation 49 CFR 171.15 deals with tracking the suspected release of hazardous materials during transportation. One subpart of that regulation (49 CFR 171.15(a)3) covers “fire, breakage, spillage, or suspected contamination occurs involving shipment of infectious substances (etiological agents).” Another subpart of that regulation (49 CFR 171.16) provides instructions for the hazardous materials incident reports. Information about shipments and incidents associated with them are maintained and reported by the Office of Hazardous Materials Safety, Research and Special Programs Administration and is developed from documentation developed under 49 CFR 171.15 and 171.16 and reported on Incident Report Form 5800.a. Summarized data are available from the world-wide-web at <http://hazmat.dot.gov/spills.htm>. The “Hazardous Materials Shipments” (October 1998) documents the most recent analysis of statistics available from the same website. More recent statistical information providing extensive details on hazardous materials shipments is also available on the web from the Hazardous Materials Information System (HMIS).

The general population risk per year (1994 to 1998) from hazardous materials transportation is 1 in 8,129,000 or 0.11 fatalities per million shipments (DOT 2001a). This risk is dominated by the transportation of six TIH materials including chlorine, ammonia, sulfur dioxide, hydrogen fluoride, fuming sulfuric acid, and fuming nitric acid; and liquefied petroleum, gas, gasoline, and explosives. In comparison, the general population risk per year for a motor vehicle accident is 1 in 6,300 or 1.7 deaths per 100 million vehicle miles, and the general population risk per year for

commercial air carrier accident is 1 in 1,568,000 or 0.7 deaths per 100 million aircraft miles or 0.19 deaths per million departures (DOT 2001a).

The number of hazardous materials shipments is about 800,000 per day with at least 10,000 involving waste hazardous materials identified generally as medical wastes and various other hazardous materials. While only about 43 percent of all hazardous materials tonnage is transported by truck, they account for approximately 94 percent of the individual number of shipments. For the hazardous materials category, which includes infectious substances, 80.27 percent of the shipments are carried by truck with the remaining 19.73 percent transported by rail (DOT 1998).

There are an estimated 4,300 non-hospital waste generating facilities (i.e., laboratories) that are potential generators of medical waste and other kinds of infectious substances including diagnostic specimens. These facilities generate 73,037 tons per year of infectious medical waste and ship about 200 tons per day (DOT 1998).

Statistical information covering the period from 1995 to 1999 was extracted from the HMIS database and is included in Appendix G.2. These data provide information on the number of incidents, major injuries, minor injuries, and deaths from the infectious substances class and separately from the “all hazardous materials classes.” These data show that infectious substance incidents are too few to even be ranked (NL=not listed) except for minor injuries in 1999. The number of annual infectious substance incidents from 1995 through 1999 is, respectively, 2, 3, 9, 10, and 166. While low and insignificant in comparison to the “all hazardous materials class” (less than one percent), it is unknown why there is an increase trend. The only injuries related to infectious materials incidents occurred in 1999 with three minor injuries.

The remainder of the data includes “all hazardous materials classes.” The percentages of incidents for highway, railway, transportation phase, result, community site, and land use site remained relative constant for the period from 1995 through 1999. For the 5-year period, human error leads the mode or cause for both highway (about 85 percent) and railway (about 60 percent) incidents, but highway incidents make up 85 percent of all modes of accidents for this class. Similarly, unloading accounts for a nearly constant 56 percent of all incidents in the transportation phase. As for the impact or result, spillage accounts for 95 percent of all incidents over the 5-year period. As may be expected since the accidents occur largely when unloading, it is nearly an even split between urban and suburban, and between industrial and commercial with all at about 30 to 50 percent.

New Mexico has consistently about 1 percent or less of all hazardous materials incidents each year while the neighboring states of Arizona and Colorado each are only slightly higher and range from 1 to 3 percent each year. Texas has also stayed rather consistent at 7 to 8 percent of all incidents. There is an apparent increase in hazardous materials incidents overall in the United States which rose from 14,700 in 1995 to 17,069 in 1999.

**APPENDIX G.2: TRANSPORTATION STATISTICAL INFORMATION FROM THE  
DOT HAZARDOUS MATERIALS INFORMATION SYSTEM**

THIS PAGE INTENTIONALLY LEFT BLANK

1995		Infectious Substance Class		Numbers			Percentages		
Class	Number	Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Commodity Summary	Rank	NL	NL	NL	NL				
<b>All Hazardous Materials Classes</b>									
<b>1995</b>		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Mode or Cause Highway		10911	10	212	1	85	53	77	14
Package Failure		1528	6	38	0	12	32	14	0
Vehicular Accident or Derailment		244	1	13	6	2	5	5	86
Other		81	2	14	0	1	11	5	0
Subtotal		12764	19	277	7	87			
Mode or Cause Railway		636	4	19	0	55	50	30	0
Package Failure		454	3	37	0	39	38	59	0
Vehicular Accident or Derailment		50	1	3	0	4	13	5	0
Other		13	0	4	0	1	0	6	0
Subtotal		1153	8	63	0	8			

1995		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Transportation Phase	En Route	2573	14	151	6	17	47	41	86
	Loading	2541	2	51	1	17	7	14	14
	Unloading	8618	9	148	0	58	30	40	0
	Temporary Storage	787	5	19	0	5	17	5	0
	Unreported	224	0	1	0	2	0	0	0
	<b>Subtotal</b>	<b>14743</b>	<b>30</b>	<b>370</b>	<b>7</b>	<b>100</b>			

Result	Vapor (Gas) Dispersion	430	8	89	3	3	19	18	12
Material Entered Waterway or Sewer	16	0	0	1	0	0	0	0	4
Spillage	14716	30	370	7	96	70	76	28	28
Fire	45	4	11	7	0	9	2	2	28
Explosion	14	0	8	5	0	0	2	2	20
Environmental Damage	43	0	4	2	0	0	1	1	8
None	20	0	0	0	0	0	0	0	0
Other	109	1	2	0	1	2	0	0	0
<b>Subtotal</b>	<b>15393</b>	<b>43</b>	<b>484</b>	<b>25</b>	<b>104</b>				

Community Type at Site	Urban	5806	8	147	4	39	27	40	57
Suburban	6263	10	116	1	42	33	31	14	
Rural	2431	11	100	2	16	37	27	29	
Unreported	243	1	7	0	2	3	2	0	
<b>Subtotal</b>	<b>14743</b>	<b>30</b>	<b>370</b>	<b>7</b>	<b>100</b>				

<b>1995</b>		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Land Use at Site	Industrial	7701	10	160	1	52	33	43	14
Commercial	6252	16	163	4	42	53	44		57
Residential	237	2	18	0	2	7	5		0
Agricultural	115	1	4	0	1	3	1		0
Undeveloped	253	1	20	2	2	3	5		29
Unreported	185	0	5	0	1	0	1		0
<b>Subtotal</b>	<b>14743</b>	<b>30</b>	<b>370</b>	<b>7</b>	<b>100</b>				

Total Incidents	United States	14743
	Arizona	130
	Colorado	345
	New Mexico	138
	Texas	1071

1
2
1
7

NOTE: Due to multiple classes being involved in a single incident, the total in one category may not match the total in another.

1996		Infectious Substance Class		Numbers			Percentages		
Class	Number	Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Commodity Summary	Rank	NL	NL	NL	NL	NL	NL	NL	NL
<b>All Hazardous Materials Classes</b>									
1996		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Mode or Cause Highway	Human Error	9929	13	131	1	83	36	73	13
	Package Failure	1538	8	37	0	13	22	21	0
	Vehicular Accident or Derailment	289	12	10	5	2	33	6	63
	Other	160	3	2	2	1	8	1	25
	Subtotal	11916	36	180	8	85			
Mode or Cause Railway	Human Error	602	2	30	0	54	18	3	0
	Package Failure	436	2	43	0	39	18	5	0
	Vehicular Accident or Derailment	43	2	840	2	4	18	92	100
	Other	31	5	2	0	3	45	0	0
	Subtotal	1112	11	915	2	8			

<b>1996</b>		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Transportation Phase		2622	20	933	117	19	43	83	98
Loading		2619	5	26	1	19	11	2	1
Unloading		7806	16	155	2	56	34	14	2
Temporary Storage		765	6	12	0	5	13	1	0
Unreported		138	0	2	0	1	0	0	0
Subtotal		13950	47	1128	120	100			

Result	Vapor (Gas) Dispersion	479	12	838	3	3	15	40	1
Material Entered Waterway or Sewer	44	2	3	2	0	2	0	1	
Spillage	13928	42	1126	119	95	52	53	48	
Fire	58	12	52	117	0	15	2	47	
Explosion	18	7	54	5	0	9	3	2	
Environmental Damage	69	6	31	4	0	7	1	2	
None	23	0	1	0	0	0	0	0	
Other	114	0	6	0	1	0	0	0	
Subtotal	14733	81	2111	250	106				

Community Type at Site	Urban	5792	14	114	0	42	30	10	0
Suburban	5438	16	116	1	39	34	10	1	
Rural	2381	16	896	118	17	34	79	98	
Unreported	339	1	2	1	2	2	0	1	
Subtotal	13950	47	1128	120	100				

<b>1996</b>		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Land Use at Site	Industrial	7229	21	154	3	52	45	14	3
Commercial	5810	12	107	2	42	26	9	2	
Residential	254	3	5	0	2	6	0	0	
Agricultural	150	4	8	2	1	9	1	2	
Undeveloped	262	7	853	113	2	15	76	94	
Unreported	245	0	1	0	2	0	0	0	
<b>Subtotal</b>	<b>13950</b>	<b>47</b>	<b>1128</b>	<b>120</b>	<b>100</b>				

Total Incidents	United States	13951
	Arizona	224
	Colorado	408
	New Mexico	137
	Texas	1004

2
3
1
7

NOTE: Due to multiple classes being involved in a single incident, the total in one category may not match the total in another.

1997		Infectious Substance Class		Numbers			Percentages		
Class	Number	Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Commodity Summary	Rank	NL	NL	NL	NL	NL	NL	NL	NL
<b>All Hazardous Materials Classes</b>									
1997		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Mode or Cause Highway	Human Error	9920	11	74	0	84	26	65	0
	Package Failure	1523	30	28	1	13	71	25	8
	Vehicular Accident or Derailment	258	1	10	10	2	2	9	83
	Other	161	0	2	1	1	0	2	8
	Subtotal	11862	42	114	12	85			
Mode or Cause Railway	Human Error	573	0	24	0	52	0	55	0
	Package Failure	449	1	14	0	41	100	32	0
	Vehicular Accident or Derailment	52	0	5	0	5	0	11	0
	Other	28	0	1	0	3	0	2	0
	Subtotal	1102	1	44	0	8			

1997		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Transportation Phase	En Route	2623	4	73	10	19	9	40	83
	Loading	2596	2	18	0	19	5	10	0
	Unloading	7786	37	74	2	56	86	41	17
	Temporary Storage	796	0	16	0	6	0	9	0
	Unreported	195	0	1	0	1	0	1	0
	<b>Subtotal</b>	<b>13996</b>	<b>43</b>	<b>182</b>	<b>12</b>	<b>100</b>			

Result	Vapor (Gas) Dispersion	568	5	32	3	4	9	15	10
Material Entered Waterway or Sewer	30	0	2	0	0	0	0	1	0
Spillage	13795	42	172	11	94	76	79	38	
Fire	63	7	5	11	0	13	2	38	
Explosion	15	1	3	4	0	2	1	14	
Environmental Damage	57	0	0	0	0	0	0	0	
None	51	0	0	0	0	0	0	0	
Other	92	0	4	0	1	0	2	0	
<b>Subtotal</b>	<b>14671</b>	<b>55</b>	<b>218</b>	<b>29</b>	<b>105</b>				

Community Type at Site	Urban	5526	3	66	4	39	7	36	33
Suburban	5777	30	62	2	41	70	34	17	
Rural	2153	9	47	5	15	21	26	42	
Unreported	540	1	7	1	4	2	4	8	
<b>Subtotal</b>	<b>13996</b>	<b>43</b>	<b>182</b>	<b>12</b>	<b>100</b>				

<b>1997</b>		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Land Use at Site	Industrial	7089	31	89	0	51	72	49	0
Commercial	5754	10	71	7	41	23	39	39	58
Residential	251	1	5	3	2	2	2	3	25
Agricultural	137	0	5	0	1	0	3	3	0
Undeveloped	261	0	6	2	2	0	0	3	17
Unreported	504	1	6	0	4	2	2	3	0
<b>Subtotal</b>	<b>13996</b>	<b>43</b>	<b>182</b>	<b>12</b>	<b>100</b>				

Total Incidents	United States	13998
	Arizona	333
	Colorado	312
	New Mexico	176
	Texas	1009

2
2
1
7

NOTE: Due to multiple classes being involved in a single incident, the total in one category may not match the total in another.

1998	Infectious Substance Class	Numbers				Percentages			
		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Class	Number	10	0	0	0	0	0	0	0
Commodity Summary	Rank	NL	NL	NL	NL				
<b>All Hazardous Materials Classes</b>									
1998		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Mode or Cause Highway	Human Error	11236	9	107	5	87	50	79	38
	Package Failure	1342	4	21	0	10	22	16	0
	Vehicular Accident or Derailment	263	4	7	8	2	22	5	62
	Other	128	1	0	0	1	6	0	0
	Subtotal	12969	18	135	13	84			
Mode or Cause Railway	Human Error	607	2	6	0	61	50	33	0
	Package Failure	309	1	9	0	31	25	50	0
	Vehicular Accident or Derailment	51	1	3	0	5	25	17	0
	Other	23	0	0	0	2	0	0	0
	Subtotal	990	4	18	0	6			

<b>1998</b>		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Transportation Phase		2959	9	47	8	19	39	27	62
En Route		2810	2	20	0	18	9	11	0
Loading		8334	11	92	5	54	48	53	38
Unloading		935	1	11	0	6	4	6	0
Temporary Storage		313	0	4	0	2	0	2	0
Unreported		15351	23	174	13	100			
Subtotal									

Result	Vapor (Gas) Dispersion	685	4	33	1	4	14	17	3
Material Entered Waterway or Sewer	39	1	2	8	0	0	3	1	21
Spillage	14852	19	150	13	94	66	76	34	
Fire	56	4	6	11	0	14	3	29	
Explosion	13	0	3	5	0	0	2	13	
Environmental Damage	52	1	4	0	0	3	2	0	
None	33	0	0	0	0	0	0	0	
Other	57	0	0	0	0	0	0	0	
Subtotal	15787	29	198	38	103				

Community Type at Site	Urban	6809	5	68	5	44	22	39	38
Suburban	5704	11	65	4	37	48	37	31	
Rural	2168	7	34	4	14	30	20	31	
Unreported	676	0	7	0	4	0	4	0	
Subtotal	15357	23	174	13	100				

<b>1998</b>		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Land Use at Site	Industrial	6576	10	68	0	43	43	39	0
Commercial	7594	10	79	8	49	43	45	62	
Residential	227	0	8	2	1	0	5	5	15
Agricultural	92	2	5	0	1	9	3	0	
Undeveloped	220	1	10	3	1	4	6	23	
Unreported	642	0	4	0	4	0	2	0	
<b>Subtotal</b>	<b>15351</b>	<b>23</b>	<b>174</b>	<b>13</b>	<b>100</b>				

Total Incidents	United States	15350
	Arizona	209
	Colorado	261
	New Mexico	117
	Texas	1188

1
2
1
8

NOTE: Due to multiple classes being involved in a single incident, the total in one category may not match the total in another.

1999	Infectious Substance Class	Numbers				Percentages			
		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Class	Number	166	0	3	0	1			
Commodity Summary	Rank	NL	NL	19	NL				
<b>All Hazardous Materials Classes</b>									
1999		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Mode or Cause Highway	Human Error	12644	19	137	2	88	53	78	29
	Package Failure	1328	11	30	0	9	31	17	0
	Vehicular Accident or Derailment	229	5	8	5	2	14	5	71
	Other	224	1	1	0	2	3	1	0
	Subtotal	14425	36	176	7	85			
Mode or Cause Railway	Human Error	690	1	19	0	65	33	59	0
	Package Failure	290	2	12	0	27	67	38	0
	Vehicular Accident or Derailment	57	0	0	0	5	0	0	0
	Other	23	0	1	0	2	0	3	0
	Subtotal	1060	3	32	0	6			

1999		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Transportation Phase	En Route	2909	15	59	5	17	38	27	71
	Loading	2723	6	44	0	16	15	20	0
	Unloading	9658	15	95	2	57	38	43	29
	Temporary Storage	974	3	19	0	6	8	9	0
	Unreported	805	0	4	0	5	0	2	0
	<b>Subtotal</b>	<b>17069</b>	<b>39</b>	<b>221</b>	<b>7</b>	<b>100</b>			

Result	Vapor (Gas) Dispersion	632	8	64	2	4	16	23	15
Material Entered Waterway or Sewer	20	0	3	0	0	0	0	1	0
Spillage	16608	29	197	2	95	58	72	15	
Fire	49	8	8	6	0	16	3	46	
Explosion	11	3	1	1	0	6	0	8	
Environmental Damage	61	2	0	2	0	4	0	15	
None	76	0	2	0	0	0	1	0	
Other	41	0	10	0	0	0	4	0	
<b>Subtotal</b>	<b>17498</b>	<b>50</b>	<b>275</b>	<b>13</b>	<b>103</b>				

Community Type at Site	Urban	8304	14	81	2	49	36	37	29
Suburban	5867	14	99	3	34	36	45	43	
Rural	2308	11	33	2	14	28	15	29	
Unreported	590	0	8	0	3	0	4	0	
<b>Subtotal</b>	<b>17069</b>	<b>39</b>	<b>221</b>	<b>7</b>	<b>100</b>				

<b>1999</b>		Incidents	Major Injuries	Minor Injuries	Deaths	Incidents	Major Injuries	Minor Injuries	Deaths
Land Use at Site	Industrial	7178	15	78	2	42	44	36	29
Commercial	8796	15	120	2	51	44	55	29	29
Residential	310	0	6	0	2	0	0	3	0
Agricultural	65	1	2	0	0	3	1	0	0
Undeveloped	200	3	7	2	1	9	3	29	29
Unreported	534	0	5	1	3	0	2	2	14
<b>Subtotal</b>	<b>17083</b>	<b>34</b>	<b>218</b>	<b>7</b>	<b>100</b>				

Total Incidents	United States	17069
	Arizona	302
	Colorado	221
	New Mexico	109
	Texas	1365

2
1
1
8

NOTE: Due to multiple classes being involved in a single incident, the total in one category may not match the total in another.